

Appl. No. : **09/808,612**
Filed : **March 14, 2001**

IN THE CLAIMS

Please amend Claims 1, 5, 19 and 23, and add new Claims 25-35 as follows:

- 5 1. (Currently amended) A method of debugging a plurality of distributed programs,
comprising:
 identifying a plurality of processes;
 initializing each of said processes;
 executing with a single thread of control among said processes; and
10 continuously switching between said processes to obtain status information relating
thereto;
 wherein said act of continuously switching comprises switching without determining
whether an event of interest has occurred.
2. (Previously presented) The method of Claim 1, wherein the act of identifying a
15 plurality of processes comprises identifying at least one simulation process and at least one
hardware process.
3. (Previously presented) The method of Claim 2, further comprising analyzing said
status information to identify at least one or more occurrences or errors within at least one of said
distributed programs.
- 20 4. (Previously presented) The method of Claim 2, further comprising:
 defining at least one object class,
 defining at least one first object subclass for said at least one hardware process; and
 defining at least one second object subclass for said at least one simulation process.
5. (Currently amended) The method of Claim 4, wherein the act of executing
25 comprises providing at least one first instance variable adapted for control of at least one of said
plurality of processes.
6. (Previously presented) The method of Claim 5, further comprising dynamically
changing polling times associated with said at least one of said plurality of processes based on
the status thereof.

7. (Previously presented) The method of Claim 5, further comprising defining an interface to a first library for said at least one hardware process.

8. (Previously presented) The method of Claim 7, further comprising accessing said first library via said interface in order to provide functions relating to at least one extension
5 instruction.

9. (Previously presented) The method of Claim 8, further comprising defining an interface to a first library for said at least one simulation process.

10. (Previously presented) The method of Claim 8, further comprising accessing said first library via said interface in order to provide functions relating to at least one extension
10 instruction, including the implementation of said at least one extension instruction.

11. (Previously presented) The method of Claim 2, wherein the act of continuously switching comprises cycling between said processes in repeated succession.

12. (Previously presented) The method of Claim 2, wherein the act of initializing comprises:

15 initializing a first process resident on a first hardware processor; and
initializing a second process on a simulator.

13. (Previously presented) The method of Claim 1, further comprising:
defining a plurality of individual subclasses for each of said plurality of processes; and
implementing at least a portion of said subclasses as a dynamically loadable library.

20 14. (Previously presented) A system for debugging heterogenous processors,
comprising:

a processor having at least one debug process running thereon, and at least one simulation
process associated and in data communication with said at least one debug process; and

at least one hardware process in data communication with said at least on debug process;
25 wherein said at least one simulation and hardware processes are controlled via a single
thread.

15. (Previously presented) The system of Claim 14, wherein said processor comprises
a digital processor embodied as an integrated circuit, and said at least one debug process
comprises a computer program adapted to run on said integrated circuit.

16. (Previously presented) The system of Claim 15, further comprising at least one external port adapted for said data communication with respective ones of said at least one hardware processes.

17. (Previously presented) The system of Claim 16, wherein said at least one
5 simulation process comprises a computer program running on said digital processor.

18. (Previously presented) The system of Claim 17, further comprising a plurality of dynamically loadable libraries, at least a portion of said libraries being adapted for communication with said at least one debug process.

19. (Currently amended) A storage device adapted for use with a computing device,
10 comprising:

a storage medium configured to store a plurality of data thereon; and

a plurality of data stored thereon, said data comprising a computer program adapted to run on a processor, and configured to debug one or more other computer programs using the method comprising:

15 identifying a plurality of simulator processes;
initializing each of said processes;
executing with a single thread of control among said processes; and
continuously switching between said processes to obtain status information
relating thereto.

20 20. (Previously presented) A method of debugging a plurality of distributed programs, comprising:

identifying a plurality of processes;

defining at least one interface between a debug process and said plurality of processes;

25 initializing each of said processes;

executing with a single thread of control among said processes; and

selectively permitting at least a portion of said processes to operate while stopping others of said processes using a single one of said at least one interface.

21. (Previously presented) A method of optimizing the operation a multi-processor
30 system comprising a plurality of software processes, comprising:

initializing each of said processes;
executing with a single thread of control among said processes;
iteratively obtaining execution profiling information from at least a portion of said
processors; and

5 optimizing the operation of said system based at least in part on said execution profiling
information.

22. (Previously presented) A method of coordinating the operation of at least one
simulation process with at least one hardware process, comprising:

initializing at least one simulation process;
10 initializing at least one hardware process;
defining at least one interface between a debug process and said plurality of processes;
executing with a single thread of control among said processes; and
controlling said at least one simulation process and said at least one hardware process via
said at least one interface.

15 23. (Currently amended) A method of debugging a plurality of extended digital
processors using a debug process, said debug process being in data communication with said
processors, comprising:

initializing each of said extended digital processors;
executing with a single thread of control among said processors using said debug process;
20 establishing a minimum polling time for each of said processors; and
obtaining status information from each of said processors based at least in part on said
polling interval.

24. (Previously presented) An apparatus adapted for debug of a plurality of
heterogeneous processors, comprising:

25 a digital processor;
at least one debug process adapted to run on said digital processor; and
a plurality of software processes distributed among said plurality of heterogeneous
processors;

wherein said plurality of processes are adapted to gather status information regarding
30 respective ones of said heterogeneous processors as controlled by said debug process.

25. (New) The apparatus of Claim 24, wherein said gathering of status information comprises switching without determining whether or not a debug event has occurred.

26. (New) The apparatus of Claim 25, wherein at least one of said plurality of software processes comprises a simulator adapted to simulate the operation of an extended processor
5 having at least one extension instruction, said apparatus further comprising an extension library comprising an implementation of said extension instruction.

27. (New) The method of Claim 1, wherein said act of switching without determining whether an event of interest has occurred comprises switching periodically irrespective of whether a debug event has occurred.

10 28. (New) The method of Claim 1, wherein said act of switching without determining whether an event of interest has occurred comprises switching without waiting for a debug event to occur.

29. (New) The method of Claim 23, wherein said extended digital processors each comprise at least one extension comprising customized hardware; and

15 said debug process is adapted to include a processor instance class for at least one of said extended processors, said instance class defining a further interface to dynamically loadable libraries associated with said at least one extension.

30. (New) The method of Claim 29, wherein said act of obtaining status information comprises obtaining said status information without determining whether a debug event has
20 occurred.

31. (New) A language-independent method of debugging a plurality of entities selected from the group consisting of: (i) a simulator, and (ii) a digital processor core, the method comprising the following steps performed within an object-oriented environment:

identifying a plurality of processes associated with said entities;

25 initializing each of said processes;

executing with a single thread of control among said processes; and

switching on a periodic basis between individual ones of said processes to obtain status information relating thereto irrespective of the status of a debug event associated with one of said processes.

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32.(New) The method of Claim 31, wherein said method further comprises defining an abstract class having a plurality of instance variables, said class providing an interface to at least one of said plurality of processes, said instance variables of said abstract class comprising:
(i) variables relating to control of at least one of said entities and examination of its state; or (ii)
5 those relating to synchronization or control of said processes.

33. (New) A method of debugging a plurality of processes using a debugger program, comprising:

initializing a poll delay associated with each process;

determining the state of said debugger program;

10 if said state comprises a first value, determining the run status of at least one of said processes;

if said at least process is running, determining a process type associated with said at least one process;

15 if said process type comprises a simulation type, advancing through at least one instruction cycle and checking the status of said simulated process; and

if said process type comprises a hardware type, delaying said debugger program for a predetermined time until a subsequent polling opportunity is available, and determining the status of said hardware process at or after said subsequent polling opportunity.

34. (New) The method of Claim 33, further comprising:

20 utilizing said debugger program to check a value of simulator variable to determine whether any currently running ones of said processes are executing in a simulator; and
if so, returning said debugger program immediately to said act of determining the state so that said process(es) executing in a simulator will run as quickly as possible.

35. (New) A method of debugging a plurality of heterogeneous processes, said
25 plurality of processes comprising a plurality of simulators and at least hardware processor, the method comprising:

running said at least one hardware processor so as to execute at substantially the speed with which execution would occur if it were not running under the control of a debugger;

30 monitoring the status of said at least one hardware processor using a single thread of control, said single thread not significantly slowing said execution; and

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running said plurality of simulators so as to maintain synchronization therebetween;

wherein said acts of running and monitoring are all performed using a single debugging program.